Radiocarbon dating of mortar: Case study of the Aqueduct in Skopje

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Radiocarbon (^{14}C) can be successfully applied to organic materials such as wood, charcoal, paper, parchment, bones etc. Mortar is a difficult material for ^{14}C dating because of potential contamination with dead carbon from unreacted limestone left during preparation of quick lime and mortar. Attempts for radiocarbon dating of mortar have been performed since the early days of the method development without significant success. The accelerator mass spectrometry (AMS) measurement technique has recently enabled development of various sample preparation techniques taking into account various phases of mortar.

The Aqueduct in Skopje (FYR Macedonia) is one of the landmarks of Skopje, a monumental building more than 380 m long. It was a part of a water-supply system with a total length of about 10 km. The age of the Aqueduct is not known –several hypotheses place it to periods between 6th and 16th century. Six mortar samples from different positions of the eastern façade were collected in July 2017.

In order to prevent the dead carbon contamination during ^{14}C analyses of carbonates in mortars, only the carbonate fraction associated with the carbonation of slaked lime, i.e., calcite that is formed only during mortar hardening had to be extracted. First, the mortar samples were broken by alternately changing temperatures from -198 °C to 80 °C. Three strategies for separation of slaked lime were used: 1) mechanical separation of calcite inclusions formed during mortar hardening (not possible for all mortar samples), 2) selection on the basis of particle size and suspension in water induced by ultrasonic shock, and 3) collection of at least two fractions of CO_2 produced by reaction of calcite with acid.

The results of the analyses will be presented and possibility of using the method for future mortar dating will be discussed.

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